

WHAT IS CLAIMED IS:

1 1. A method for organizing cache memory for hardware acceleration of the FDTD
2 method in a very high bandwidth, dual-port on-chip memory, comprising:
3 creating a plurality of small banks of internal memory; and
4 arranging the plurality of small banks of internal memory so that all data
5 dependencies are capable of being statically wired.

1 2. A method for organizing cache memory for hardware acceleration of the FDTD
2 method in a very high bandwidth, dual-port on-chip memory, comprising:
3 providing a first plurality of input memory banks that connect to corresponding one-
4 cycle delay elements;
5 connecting the delay elements to corresponding computation engines;
6 providing a second plurality of input memory banks that connect to corresponding
7 computation engines; and
8 connecting the computation engines to corresponding output memory banks.

1 3. A method for organizing cache memory as recited in claim 2, wherein the first
2 plurality of input memory banks handles fields having i and j directional dependencies.

1 4. A method for organizing cache memory as recited in claim 3, wherein each of the
2 first plurality of input memory banks includes a first channel that handles fields having i directional
3 dependencies, and a second channel that handles fields having j directional dependencies.

1 5. A method for organizing cache memory as recited in claim 2, wherein the second
2 plurality of input memory banks handles fields having k directional dependencies.

1 6. A method for organizing cache memory as recited in claim 2, wherein the output
2 memory banks buffer updated fields before storing the updated fields to a bulk memory.

1 7. A method for organizing cache memory as recited in claim 2, wherein at least six
2 output memory banks are provided.

1 8. An organization scheme of cache memory for hardware acceleration of the FDTD
2 method in a very high bandwidth, dual-port on-chip memory, comprising:
3 a first plurality of input memory banks connected to corresponding one-cycle delay
4 elements;
5 a plurality of computation engines connected to corresponding delay elements;
6 a second plurality of input memory banks connected to corresponding computation
7 engines; and
8 a plurality of output memory banks connected to corresponding computation engines.

1 9. An organization scheme of cache memory as recited in claim 8, wherein the first
2 plurality of input memory banks handles fields having i and j directional dependencies.

1 10. An organization scheme of cache memory as recited in claim 9, wherein each of the
2 first plurality of input memory banks includes a first channel that handles fields having i directional

3 dependencies, and a second channel that handles fields having j directional dependencies.

1 11. An organization scheme of cache memory as recited in claim 8, wherein the second
2 plurality of input memory banks handles fields having k directional dependencies.

1 12. An organization scheme of cache memory as recited in claim 8, wherein each of the
2 plurality of output memory banks buffer update fields before storing the updated fields to a bulk
3 memory.

1 13. An organization scheme of cache memory as recited in claim 8, wherein the plurality
2 of output memory banks comprises at least six output memory banks.

1 14. A method of using an organization scheme of cache memory for hardware
2 acceleration of the FDTD method in a very high bandwidth, dual-port on-chip memory, the
3 organization scheme comprising: a first plurality of input memory banks connected to corresponding
4 one-cycle delay elements, a plurality of computation engines connected to corresponding delay
5 elements, a second plurality of input memory banks connected to corresponding computation
6 engines, and a plurality of output memory banks connected to corresponding computation engines,
7 the method comprising:

8 loading dual fields of data into the first plurality of input memory banks, and
9 simultaneously moving old values in the first plurality of input memory banks to the second plurality
10 of input memory banks;

11 loading primary fields of data into the second plurality of input memory banks;

12 beginning computations and iterating over the primary fields of data with the plurality
13 of computation engines;
14 storing updated fields in the plurality of output memory banks when updated fields
15 emerge from plurality of computation engines; and
16 writing updated fields to bulk storage.

1 15. A method of using an organization scheme of cache memory as recited in claim 14,
2 wherein the loading dual fields for data into the first plurality of input memory banks continues until
3 the first plurality of input memory banks are full.

1 16. A method of using an organization scheme of cache memory as recited in claim 14,
2 further comprising:
3 determining whether the method is complete, wherein if the method is complete, the
4 method stops, otherwise the method moves to the next data and repeats.